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The holasteroid echinoid *Echinocorys* from the Maastrichtian of Western Australia

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Abstract

Echinocorys stomias sp. nov. is described from Maastrichtian strata of the Giralia Range, Western Australia. This represents the first description of any holasteroid genus from the Cretaceous of Australia. The species is large and can be distinguished from all other described species of the genus on the basis of its large peristome. This is considered to be a paedomorphic character, resulting from changes to growth allometry of the peristome.

Introduction

The holasteroid echinoid *Echinocorys* is a common, geographically widespread genus which has been collected from Turonian to Paleocene strata in Belgium, Germany, England, France, Poland, Denmark, Spain, Turkey, USSR, USA, Cuba, Madagascar and Australia (Lambert & Thiéry 1924; Kier & Lawson 1978; Foster & Philip 1978). In Australia this genus has previously been described only from the Paleocene Wadera Calcarenite in the Giralia Range in Western Australia (Foster & Philip 1978).

In this paper I describe what is the first known Cretaceous holasteroid from Australia, and only the second species of *Echinocorys* to be described from the Southern Hemisphere. Cretaceous echinoids are very rare in Australia, only two species, *'Micraster' sweeti* Etheridge, 1892 and *Goniocidaris comptoni* (Glauert, 1926) (see McNamara 1986), having been described. The Cretaceous species of *Echinocorys* described herein is from the Late Maastrichtian Miria Formation of the Giralia Range in Western Australia. It represents the first echinoid to be described from the Maastrichtian of Australia.

The Miria Formation is a thin (0.6-2.0 m) very fossiliferous calcarenite, that occurs over a strike length of about 80 km on the eastern and western flanks of the Giralia Range immediately south of Exmouth Gulf, Western Australia. The fauna of the Miria Formation is dominated by molluscs, in particular ammonites (Brunnschweiler 1966; Henderson & McNamara 1985a) and to a lesser extent, brachiopods, corals, sponges, bryozoans and shark teeth. Echinoids form a very

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minor part of the fauna. In addition to the *Echinocorys* the only other echinoids known are two very poorly preserved internal moulds of possible phymosomatids.

Preservation

The fossils of the Miria Formation are generally preserved as phosphatic steinkerns. Analysis of the preservation of the cephalopods of the Miria Formation has revealed a complex preservational history, with repeated episodes of burial and exhumation (Henderson & McNamara 1985b). The *Echinocorys* specimens are preserved either as incomplete phosphatic steinkerns, often with some weathered calcite test remaining, or, in one case, as an incomplete calcitic adoral surface.

The presence of burrows within the steinkerns (attributable to the action of crustaceans and worms) and epibionts (principally bryozoans and serpulids) on both the phosphatic steinkerns and on calcitic test, are evidence for a complex preservational history for these specimens, comparable with that experienced by the Miria Formation cephalopods. The incomplete nature of the tests is probably attributable to their breakage either prior to fossilisation or during a period of exhumation during the fossilisation process. There is evidence that the weathered nature of the calcitic test of some specimens occurred by partial dissolution of the test while it was exposed to sea water either prior to burial or during a period of exhumation. This is shown by the presence on one specimen (WAM 82.3088) of a serpulid attached to a partially dissolved interambulacral plate. Such partial dissolution must obviously have been instrumental in promoting subsequent mechanical breakage of the test.

The absence of other irregular echinoids in this fauna is likely to be a reflection not so much of their original absence, but of their thin tests. The test of the *Echinocorys* specimens is particularly thick (up to 3.5 mm), rendering this species more capable of withstanding the dissolution of calcium carbonate which was experienced by many other taxa.

Materials and methods

The collections, on which this study was made, are housed in the Western Australian Museum (WAM), the Museum of Victoria (MV), the Rijksuniversitair Centrum Antwerpen (RUCA) and the collection of Mrs B. Schekkerman (BS). Collections were made by the author, assisted by Prof. G.M. Philip, Mr G.W. Kendrick, Dr T.A. Darragh and Dr R.A. Henderson in 1979 and 1983, and by Dr J.F. Geys and Mrs B. Schekkerman in 1985.

Measurements were made with a vernier calliper to an accuracy of 0.1 mm. A number of parameters are expressed as percentages of either test length (%TL), test width (%TW) or test height (%TH).

Systematics

Class Echinoidea Leske, 1778
Order Holasteroida Durham & Melville, 1957
Family Holasteridae Pictet, 1857
Genus *Echinocorys* Leske, 1778

Type species
Echinocorys scutatus Leske, 1778, by subsequent designation of Lambert 1898, p. 179.

Echinocorys stomias sp. nov.

Figures 1-3

Holotype
WAM 84.442 (Figs 1A, 3B) from the Giralia Range, Western Australia; gully draining east, 3.8 km north of Bullara — Giralia Road; Giralia 1: 100 000 map sheet, G.R. KV 175950 (locality 17 of Henderson & McNamara 1985a, text-fig. 1).

Paratypes
WAM 82.3088, 84.420, 84.441, 84.443, 86.1388, MV P102120, P102398, RUCA 20152, from localities 12, 15, 20 and 26 of Henderson & McNamara 1985a in the northern part of the Giralia Range.

Other material
MV 101628, 102397, BS 5.148a, b.

Diagnosis

A very large species of *Echinocorys,* with conical test and relatively large peristome.

Description

Test very large, reaching a maximum known length of 103 mm, although one incomplete test (WAM 86.1388) would probably have exceeded this, reaching, perhaps, 106 mm in length; maximum width, 80-87%TL, at about mid-test length; height 71-78%TL. Test conical (Figure 2B), with ambitus situated close to adoral surface, at about 8%TH. Apical system poorly preserved; situated centrally (Figure 2A). Ambulacra 30%TL wide at ambitus; poriferous zone up to 18%TL wide. Pore pairs situated slightly perradially; more than 60 in each column; interambulacra occupy 35%TL at ambitus. At ambitus ambulacral plates 5.5 times wider than long; interambulacral plates nearly 4 times wider than long. In largest specimen (WAM 82.3088) there are an estimated 50 plates on the aboral surface in each ambulacral column.

Adoral surface relatively flat, apart from gently convex plastron, which rises to a rostrum posteriorly. Peristome appears very large in internal moulds (Figure 1A), reaching 25%TL in width and being 13-16%TL long. However, analysis of adoral

Figure 1 *Echinocorys stomias* sp. nov., A, holotype, WAM 84.442, adoral surface. Note that the labrum and first ambulacral plates are missing, making the peristome appear slightly larger than its original size. B, paratype, WAM 82.3088, lateral profile; both x1.

Figure 2 *Echinocorys stomias* sp. nov., A, paratype, RUCA 20152, aboral surface; B, BS 5.148, posterior view; both x1.

plating shows that in these specimens some of the basicoronal plates are not preserved, giving the echinoid the appearance of having a larger peristome than it actually had. Evenso, where the adoral plating is complete near the peristome (Figure 3) the peristome can be seen to have been still relatively large, up to 15%TL in width. The peristome is moderately sunken, area between peristome and anterior ambitus (about one-fifth TL) being strongly convex. Labrum projects slightly anteriorly; strongly constricted close to peristome, but posteriorly broadens and becomes parallel-sided toward plastron (Figure 3). Meridosternous plastron narrow, width 16%TL. Form of periproct unknown.

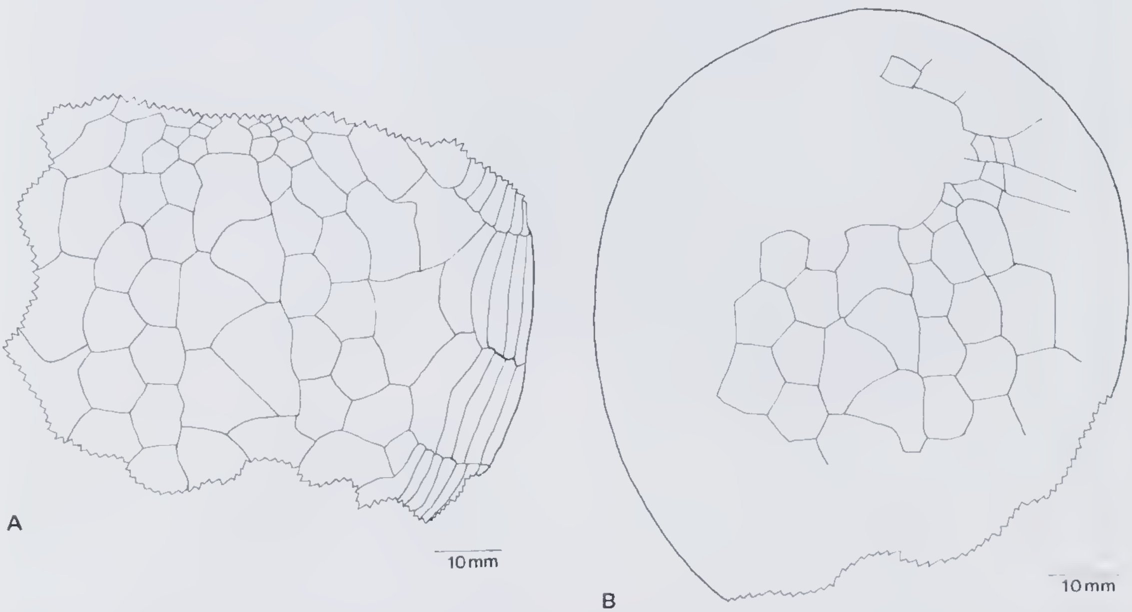

Figure 3 *Echinocorys stomias* sp. nov., A, drawing of adoral plating of WAM 86.1388, x1; B, drawing of adoral plating of WAM 84.442, holotype, x1.

Discussion

Echinocorys stomias can be distinguished from the Paleocene *E. australis* from the Wadera Calcarenite in the Giralia Range (Foster & Philip 1978) by its attainment of a much larger size; its broader and more conical test; and its relatively much larger peristome. Furthermore, it has a greater concentration of much broader, short ambulacral and interambulacral plates (compare Figure 2B with Foster & Philip 1978, pl. 92, fig. 3).

The most exhaustive works on *Echinocorys* are those by Lambert (1903) and Smiser (1935) on Belgian Senonian species. *E. stomias* compares with one of these species, *E. ovatus* (Leske), in size. However, the two species can be distinguished by test shape and peristome size. Unlike *E. stomias,* in which the test is conical, the ambitus being very low, close to the adoral surface of the test, the test of *E. ovatus* is more hemispherical in shape, with a much higher ambitus (Smiser 1935, Fig 5).

In his analysis of the evolution of *Echinocorys* in Belgium, Smiser (1935, pl. 1) has shown how there was a tendency for an initial increase in test size, from the oldest, Turonian species, *E. gravesi,* to the Santonian-Campanian *E. ovatus.* Later Campanian species, however, tend to be smaller. These younger forms, though, do compare with the Maastrichtian *E. stomias* in their possession of a more conical test than in many earlier species. However, these species all possess a much smaller peristome than *E. stomias,* as well as being much smaller.

Of other Maastrichtian species of *Echinocorys,* such as *E. fakhryi* Fourtau, 1907, from Egypt, *E. tercensis* Lambert, 1907, from France, *E. darderi* Lambert, 1935, from Spain and *E. tenuituberculatus* Lermerie, 1851 *madagascarensis* Besairie, 1930, from Madagascar, *E. stomias* differs from all these species in its much larger size and, in particular, its very much larger peristome. There is some similarity between *E. stomias* and *E. darderi* (Lambert 1935, p. 363, pl. 42, figs 1, 2) in the lateral test profile, but *E. stomias* differs in its wider ambulacra, in addition to the features mentioned above.

The possession of a relatively larger peristome in *E. stomias* compared with other species of *Echinocorys,* probably arose by changes to growth allometry. McKinney (1984) has demonstrated how the evolution of a much larger peristome in an *Oligopygus* lineage in the Eocene of Florida occurred by an extrapolation of the ontogenetic trajectory to a larger size in the species with the largest peristome, *O. wetherbyi* de Loriol. Comparison of *E. stomias* with species of comparable test size, such as *E. ovatus,* shows that the large peristome size of *E. stomias* is not merely a function of the size of the test, as the peristome of *E. ovatus* is relatively smaller than in *E. stomias.* The large peristome of *E. stomias* probably reflects a change in growth allometry. In most echinoids the peristome develops with negative allometry, compared with test size; in other words it becomes relatively smaller as the test increases in size. The peristome of *E. stomias* may be considered to have undergone a reduction in degree of negative allometry compared with other *Echinocorys* species, approaching closer to, though not reaching, isometry. Such reduction in negative allometry resulted in the adult *E. stomias* probably resembling ancestral juveniles in its retention of a relatively large peristome, thus demonstrating the development of paedomorphosis by neoteny (reduction in negative allometry). The functional significance of the increased peristome size was the ability of the echinoid to ingest a greater volume of sediment, perhaps indicating a general reduction in the nutrient value of the food source.

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